Arctic ice buoys open window on climate change

By Alexandra Witze
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ICE CAMP BORNEO, 89 DEGREES NORTH — Some oceanographers take monthlong research cruises in tropical waters. Far fewer go where temperatures plunge below minus 20 degrees, even as spring arrives.

But only here, at the top of the world, can scientists really understand what is happening at the Earth's poles.

Late last month, a team led by researchers from the University of Washington journeyed to the center of the Arctic ice pack, just 60 miles from the North Pole. Here they scurried across the sea ice, stabbing holes to take water samples and plant scientific buoys.

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Oceanographer Tim Stanton examines the buoy he designed to study the Arctic Ocean beneath the North Pole's ice pack at a research station in the Arctic last month.

If all goes well, the buoys will drift with the ice pack for the next year, serving as remote scientific sentinels as they radio back information about ocean conditions. The data — about the ocean's temperature, salinity and other factors — will offer a key glimpse into major changes that are occurring in the ocean around the North Pole. This spring's work marks the fourth year of a five-year program called the North Pole Environmental Observatory.

"The big picture with the Arctic is that things are warming up and the ice is getting thinner and melting," said Jim Overland, an oceanographer at the National Oceanographic and Atmospheric Administration's Pacific Marine Environmental Laboratory in Seattle. "The whole idea of the drifting station is that we build up enough years of data that we can see the changes and how they occur."

Without such information, scientists cannot understand how climate change affects the Arctic.

First, the scientists must carefully weigh and pack each piece so it can survive a rough airplane landing near a floating ice camp named Borneo. Then they must find the perfect spot to deploy the buoys — preferably a flat chunk of ice surrounded by a well-developed system of pressure ridges that will accommodate the grinding forces that shear apart the ice pack.

And, of course, the scientists must always carry a rifle in case they run into a polar bear.

Every bit of data is priceless when so little is known about the region, said Tim Stanton, an oceanographer at the Naval Postgraduate School in Monterey, Calif.

"One buoy buys you much more than zero buoys," he says.

Over the past decade, the Arctic Ocean has undergone dramatic changes, said Jamie Morison of the University of Washington, the project's leader. Atmospheric pressure over the central Arctic has dropped, causing changes in ocean currents.

Those changes caused the ice cover to spread out more, opening up more water. Heat from the sun then can melt ice more rapidly, kicking off a cyclical effect that is hard to stop, Morison said.

At the same time, Arctic ice is under attack from below. A warm layer of water from the Atlantic Ocean is pushing ever farther into the Arctic, thinning or even destroying a cold, salty layer that insulates the ice. Without the cold layer, the ice can melt more rapidly than before, Morison said.

"That's one of the real signals of change in the Arctic," he said.

How that heat moves through the upper layers of the ocean is the focus of the buoy designed by Stanton. The buoy rests on the ice, its dome-shaped top keeping snow from accumulating. Beneath it stretches a 16-foot pole, laden with instruments to measure temperature, salinity and momentum created by the ice-pack movement.

From these factors, Stanton can calculate the heat flux within the ocean — a quantity that has not been well-measured until now, he said. Measuring that can help oceanographers better understand how warm Atlantic water might affect the Arctic Ocean, he said.

Nearby, oceanographer Sigrid Salo of the Pacific Marine Environmental Laboratory has installed a number of other buoys.

One is a weather station, measuring temperature along a 9-foot-high mast. Two are Webcams, scheduled to broadcast live pictures of the North Pole at www.arctic.noaa.gov. Two are thermometers that plunge through the ice, measuring how thick the ice grows in winter and how thin it gets in summer. And two are radiometers, small devices that sit on the ice and measure radiation from the sun.

No one has ever left radiometers like these unattended on the ice before, Salo said, because frost usually covers them and renders them useless.

But her team designed a set of small heaters and fans, powered by eight 75-watt solar panels, that will constantly blow warm air over the translucent bubbles that receive the sun's radiation. The heat should keep the devices clear enough of frost to continue working at least until winter, she said.